more accurate, if drier, title for the book would have been "Trends in European Prehistoric Research."

Though this approach obviously provides a valuable guide to innovative research, it occasionally leads to quaint results, as sometimes older but more plausible or better-founded conclusions are passed over in silence. An extreme case occurs on p. 257 when information reported by Julius Caesar around 50 B.C. and commented on endlessly ever since reappears in a secondary quotation as a new understanding with a publication date of 1974. In all fairness, the author mitigates this eccentricity by adding how Szabo's 1971 study of chieftains' names on the Boii (in Bohemia) tribe's coins reflect in detail the same change in social structure Caesar observed. Another curious outcome is that sometimes contradictory results are presented several pages apart without any attempt to reconcile the differences. On p. 155 the early bronze-working Bell Beaker folk are obviously a new people, but on p. 187 they are simply local individuals, with deep roots among the previous inhabitants, who happen to have attained high status as symbolized by a bell-shaped drinking beaker in the grave.

In general, Phillips selects papers that exemplify quantitative methods or exchange networks and commercial relationships and their subsequent effects on the social structure. A specific trend recurrently touched upon in the book is the study of raw materials and their exploitation, manufacturing processes (briefly), and distribution of finished artifacts. In accordance with other modish archeological leaders, Phillips tends to emphasize "homebody" archeology, with the continuation of local groups in one place, but in contact, primarily for economic or commercial reasons, with their neighbors. This departs from older summaries, which tended to emphasize the adventurers, explorers, and migrants of European prehistory. Such formerly key cultures as Corded Ware, Bell Beaker, and the Scythic horse nomads receive little wordage and fewer illustrations here.

As in most such books, the lower Paleolithic before fully modern *Homo sapiens* evolved is underemphasized, partly no doubt because hominids did little trading or had little use for exotic materials before the Upper Paleolithic began around 35,000 years ago. Northern Europe and the western Mediterranean (the latter Phillips's own geographic specialty), which have been the subject of important recent studies, are also underemphasized. The Neolithic farmers' astronomical alignments, which are surely one set of the wonders of the prehistoric world and which must have helped prehistoric farmers by aiding in determining the favorable time of the year to plant crops, are only briefly referred to, without comment on how such ostensibly esoteric developments actually fit quite well with the "homebody" archeology stressing local ecology in vogue these days.

Here I give a representation, chosen by the use of random numbers for selecting pages and paragraphs from each chapter, of the papers noted in this book. These include Boskinki's 1976 analysis, based on the number of different kinds of flint utilized, of the variation in Neanderthal's different kinds of tool assemblages. The Kniegrotte evidence can be used to argue that late Pleistocene Magdalenians were very protective of their reindeer, with selective killing of deer in an age-sex ratio very similar to that for early domesticated animals in the Near East, implying that these reindeer were practically domesticated also.

For the Neolithic, here cited is Sielmann's well-thought-out prediction that greater use of sheep and goats would be found on the drier Bandkeramik Neolithic sites of 6000 years ago, whereas in areas with more water meadows cattle would be kept. For the Bronze Age there is Welinder's 1977 model of southwestern Sweden, where residually neighboring chiefs and handicraft specialists funneled metal and other finished products to farming villages, which in turn, of course, sent agricultural products to these worthies. A solid example of several similar recent studies stems from Wetwang Slack in Yorkshire, where clear differences in the amount and kind of grave artifacts and grave food must reflect differences in Iron Age socioeconomic status.

This emphasis on recent studies, and consequently on trading, precludes the emergence of a comprehensive understanding of European prehistory. The most secure substantive result is the antiquity of trading and exchange networks, a startling discovery in accord also with emerging evidence from the Near East and parts of the New World. The reader will gain a clear picture of the most significant new directions in Europeanist research. The author contributes a "postface" wherein she delineates what she regards as the important sectors remaining for development. Despite the predilection for latest fashions in the main text, she bucks the trend by calling for more precise chronologies, not as an end in themselves, to be sure, but to facilitate understanding of social organization and functional relationships by confirming strict contemporaneity of the interacting parts of supposed ancient systems. She warns that, though rescue or salvage archeological digs will provide surprises and draw off an even larger share of research funds in the future, these must ultimately be tied in with well-thought-out pure-research projects, based on theoretical considerations, sampling particular areas and periods. Only then can archeology continue to develop its scientific status, whatever ancillary scientific techniques it may use otherwise.

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Atomic Physics

Atomic Structure. E. U. CONDON and HALIS ODABAŞI. Cambridge University Press, New York, 1980. xviii, 658 pp., illus. Cloth, $49.95; paper, $18.95.

In 1935, in *The Theory of Atomic Spectra*, Edward Condon and George Shortley undertook "a survey of the present status of the problem of interpreting the line spectra due to atoms." The monograph soon became the definitive work on the application of quantum theory to atomic spectra, and such it has remained over the years. Remarkable for its clarity of thought and expression, it has been an indispensable reference work for generations of physicists, chemists, and astronomers.

Subsequent years have brought continuing advances in the field. In particular, two new mathematical techniques have become important, if not indispensable, theoretical tools for treating the structure of many-electron atoms. The first, generally referred to as Racah algebra in recognition of the seminal work of Giulio Racah in the 1940's, systematized techniques explained in *The Theory of Atomic Spectra* for the evaluation of operator matrix elements within a representation of collective (coupled) many-particle angular momentum states. During the 1960's powerful graphical techniques were developed by A. P. Jucys (or Yutsis) and his co-workers that further simplify this central practical problem. The second technique, group theory, was deliberately omitted from *The*

Theory of Atomic Spectra on the grounds that it was too unfamiliar to physicists of that era. Although it remains true that much of theoretical atomic structure can be analyzed by algebraic methods alone, group theory has now become an integral part of the education of chemists and physicists.

The omission of these two techniques from the 1935 monograph loomed large over the years, and Condon often expressed his intention of revising the book to incorporate them. Rumors of such an undertaking had circulated for at least a decade before Condon died in 1974. Ultimately the efforts of Halis Odabaşı, first as a postdoctoral assistant and then as a coauthor, brought forth the present monograph.

As it turned out, Condon and Odabaşı's *Atomic Structure* is (intentionally) not simply a modern Condon and Shortley. It is a very different book, in outline, in format, and in style.

The present volume (intended as the first of two) concentrates upon a particular aspect of atomic structure: the theory of steady-state unexcited behavior of bound electrons subject only to electrostatic forces. For a broader perspective on atomic structure—encompassing electromagnetic transitions, electromagnetic forces, external perturbations, and the origin of spectral lines—one might select the comprehensive *Introduction to the Theory of Atomic Spectra* (1972) by I. I. Sobel'man or the smaller *Quantum Mechanics of Atomic Spectra and Atomic Structure* (1970) by M. Mizushima. Each of these uses Racah methods and would make a satisfactory textbook, reference work, or self-study source book.

Following a historical review of the development of quantum mechanics and a presentation of conventional quantum theory and angular-momentum eigenstates (which they term "proper states"), Condon and Odabaşı devote the bulk of the book to Racah methods and group theory.

Their treatment of Racah methods is particularly lengthy (although it makes no mention of graphical methods) and includes laboriously detailed examples of particular cases, written out as lengthy equations. These make the book more usable as a companion to a self-study course than as a reference or a refresher. Although it is useful for the diligent student to be able to check his or her algebraic manipulations against worked examples, it hardly seems necessary to set in type all of the special cases; an occasional exercise for the reader would not be amiss. The tabulation in an appendix of formulas relating configuration average energies to Slater-Condon radial integrals may well be the most useful portion of the book.

The treatment of group theory is, in essence, a precis that attempts to define many of the terms that occur in the application of group theory to atomic physics. The symmetric group and Lie groups, rather than the point groups needed by quantum chemists, receive emphasis here, so that the exposition serves primarily as an aid to understanding the work of Judd on equivalent-electron configurations. There is no mention of the Gelfand representations of the unitary groups, which offer powerful means of greatly simplifying the calculations of atomic structure.

As there was in *The Theory of Atomic Spectra*, there is discussion here of the radial distribution of electron charge (complementing the angular distribution derived from the spherical harmonics of angular momentum theory), first in the Thomas-Fermi approximation of an electron gas and then in the self-consistent field (SCF) approximation of Hartree, Fock, and Slater. There is no mention of other effective model potentials. Although the intervening years have greatly enlarged the number of solved examples, the basic equations and physics remain as described in the 1935 book or, in more detail, in J. C. Slater's *Quantum Theory of Atomic Structure* (1960).

The final chapter of the book, like that of *The Theory of Atomic Spectra*, examines some of the experimental and theoretical (SFC) regularities in configuration energies and ionization potentials. The discussion here seems somewhat outdated. For example, although the authors have referred in an earlier chapter to Layzer's 1959 theory of complexes, they do not here show how this form of configuration degeneracy accounts for deviations from elementary predictions for energy term spacings. There is no mention of the powerful perturbation techniques based upon treating the inverse nuclear charge $1/Z$ as an expansion parameter, nor is there any treatment of configuration mixing.

The Theory of Atomic Spectra was important for its presentation of a systematic approach to the treatment of many-electron atoms, and particularly for its presentation of angular momentum theory. During the intervening years other books have appeared that treat this subject; Condon and Odabaşı list several of them. Perennials such as *Advances in Atomic and Molecular Physics* or the *Annual Review of Astronomy and Astrophysics* provide valuable summaries of contemporary research. Numerous monographs deal with applications of Racah methods to atomic structure and the number of books treating elementary atomic structure is legion. Within this literature Condon and Odabaşı's book will take its place as a useful specialized treatment of the free-atom many-electron electrostatic-interaction problem as it appeared in the early 1960's.

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Plant Growth and Development

Genome Organization and Expression in Plants. Proceedings of a NATO Advanced Study Institute, Edinburgh, July 1979. C. J. LEAVER, Ed. Plenum, New York, 1980. xii, 608 pp., illus. $59.50. NATO Advanced Study Institutes Series A, vol. 29.

Much of the work reported in this useful volume results from the application of the techniques of nucleic acid hybridization, DNA cloning, DNA sequencing, and restriction endonuclease mapping to long-standing questions of genome organization. Several papers (for example, "Contrasting patterns of DNA sequence organisation in plants," W. F. Thompson, M. G. Murray, and R. E. Cuellar; "On the evolution and functional significance of DNA sequence organisation in vascular plants," Arnold J. Bendich and Bernard L. Ward; and "The evolution of plant genome structure," R. Flavell *et al.*) deal with the large amount of DNA in the plant genome, the large variations, even within a genus, in the amount of DNA, and the organization of DNA in repetitive and single-copy sequence lengths. The general conclusions of these papers are that there is little relationship between DNA sequence organization and organismic complexity, that much of the DNA in the larger genomes has no direct role in the organism and is therefore free to change rapidly through amplification, translocation, mutation, and deletion, and that much of the DNA that behaves as nonrepeated during renaturation has evolved from families of repeated sequences. The structural gene sequences are a small percentage of the total nonrepeated DNA sequences.

The DNA content of plant mitochondria is several times greater than that of animal mitochondria and about twice that of yeast mitochondria ("Physico-chemical and restriction endonuclease analysis of mitochondrial DNA from high plants," Francis Quetier and